This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

---

1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-7 + 4i)(10 + 3i)$$

The solution is $-82 + 19i$, which is option A.

A. $a \in [-86, -81]$ and $b \in [19, 20]$

* $-82 + 19i$, which is the correct option.

B. $a \in [-61, -57]$ and $b \in [-65, -58]$

$-58 - 61i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-86, -81]$ and $b \in [-19, -15]$

$-82 - 19i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-71, -69]$ and $b \in [11, 16]$

$-70 + 12i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-61, -57]$ and $b \in [56, 65]$

$-58 + 61i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

2. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 + 66i}{-3 - 8i}$$

The solution is $-5.38 - 7.64i$, which is option A.

A. $a \in [-6, -4.5]$ and $b \in [-7.9, -7.2]$

* $-5.38 - 7.64i$, which is the correct option.

B. $a \in [-394, -390.5]$ and $b \in [-7.9, -7.2]$

$-393.00 - 7.64i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [8, 9.5]$ and $b \in [2, 2.55]$

$9.08 + 2.22i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [13.5, 17]$ and $b \in [-8.6, -7.9]$

$15.00 - 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-6, -4.5]$ and $b \in [-558.05, -557.25]$

$-5.38 - 558.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{25921}{529}}$$

The solution is Integer, which is option E.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Irrational

These cannot be written as a fraction of Integers.

E. Integer

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -161.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

4. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 1 \div 8 * 2 - (4 * 6)$$

The solution is -15.250, which is option A.

A. $[-15.72, -15.08]$

* -15.250, which is the correct option.

B. $[28.19, 28.67]$

28.500, which corresponds to not distributing a negative correctly.

C. $[32.92, 32.95]$

32.938, which corresponds to not distributing addition and subtraction correctly.

D. $[-15.17, -14.51]$

-15.062, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

5. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{50625}{625}}$$

The solution is Integer, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Integer

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -225.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

---

6. Simplify the expression below and choose the interval the simplification is contained within.

$$17 - 13^2 + 9 \div 8 * 20 \div 15$$

The solution is -150.500, which is option A.

A. $[-151.9, -148.6]$

* -150.500, this is the correct option

B. $[-153.6, -151.4]$

-151.996, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

C. $[185.5, 187.3]$

186.004, which corresponds to two Order of Operations errors.

D. $[186.3, 188.4]$

187.500, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

---

7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-2 - 6i)(-10 + 5i)$$

The solution is $50 + 50i$, which is option A.

A. $a \in [50, 52]$ and $b \in [50, 51]$

* $50 + 50i$, which is the correct option.

B. $a \in [-15, -6]$ and $b \in [-72, -63]$

$-10 - 70i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-15, -6]$ and $b \in [67, 73]$

$-10 + 70i$, which corresponds to adding a minus sign in the second term.

D. $a \in [19, 21]$ and $b \in [-37, -23]$

$20 - 30i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [50, 52]$ and $b \in [-51, -49]$

$50 - 50i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

---

8. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{7}} + \sqrt{3}i$$

The solution is Pure Imaginary, which is option A.

A. Pure Imaginary

* This is the correct option!

B. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

C. Nonreal Complex

This is a Complex number ($a + bi$) that is not Real (has i as part of the number).

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

---

9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 + 88i}{4 - 6i}$$

The solution is $-13.62 + 1.58i$, which is option E.

A. $a \in [-14, -13]$ and $b \in [81, 82.5]$

$-13.62 + 82.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [5, 7]$ and $b \in [11.5, 13]$

$6.69 + 11.96i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-708.5, -707.5]$ and $b \in [0.5, 2.5]$

$-708.00 + 1.58i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-11.5, -9.5]$ and $b \in [-15.5, -14]$

$-11.25 - 14.67i$, which corresponds to just dividing the first term by the first term and the second by the second.

E. $a \in [-14, -13]$ and $b \in [0.5, 2.5]$

* $-13.62 + 1.58i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

---

10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{169}{0}} + \sqrt{221}i$$

The solution is Not a Complex Number, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Not a Complex Number

* This is the correct option!

D. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
